RELATIONSHIP BETWEEN ALTITUDINAL CHANGES AND DISTRIBUTION OF RATS : A PRELIMINARY STUDY FROM GUNUNG BOTOL GUNUNG HALIMUN NATIONAL PARK

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ABSTRACT

A study on the distribution and abundance of high mountain rat was carried out at Gunung Botol, Gunung Halimun National Park. Observation was conducted at three stations located at the mountain top, middle and foot of the mountain. The results indicated that four species of rat were recorded from Gunung Botol, *namely Maxomys bartelsii, Niviventer lepturus, Niviventer fulvescens* and *Niviventer cremoriventer*. Our data showed a relationship between number of individuals observed of each species with altitudinal gradients. While estimation of murid rodent population between altitudinal changes indicated there was no differences between the stations observed. An analysis was conducted to investigate any possible association between rat abundance against environment factors that could associate with altitude. The results indicated that ground covering and tree circumference, as well as interspecific competition seemed to be important factors in influencing the differences in distribution of each rat species.

Key words: Tikus dataran tinggi/high mountain rats, penyebaran/distribution, Taman Nasional Gunung Halimun/Gunung Halimun National Park

INTRODUCTION

Small mammal plays an important role in nature such as pollinator, seed dispersal, insect population control and as a food/prey for small carnivorous (Suyanto *et al,* 1997 and Alikodra 1990). Considering the importance of animal and plant biodiversity for sustainable development, conservation is necessary to protect these natural resources. So, it requires some understanding of the biological aspects of these animals.

This research is on the ecological study of the selected rodent. In particular, we selected an important keystone species because their limited distribution and their roles since they maintain the ecological natural balance in this conservation area, for example *Maxomys bartelsii* and *Niviventer lepturus.* Also, this study was conducted to examine any relationship between rat distribution and altitudinal changes.

It is expected the results can assist in managing the Gunung Halimun National Park, particularly conservation effort of these selected rodents.

OBJECTIVES

1. Documentation the keystone species of mountain murid rodent.
2. Evaluate the distribution, abundance and population number.

STUDY AREA

Gunung Halimun National Park is the most ideal area for this study because it has an array of high peaks and has rich rodent fauna. Also, it contains a wide variety of montane vegetation. This region has recently been surveyed and we know Gunung Botol has rich rodents including *Maxomys bartelsii* and *Niviventer lepturus* (Suyanto *et al,* 1997). Our research focussed at Gunung Botol, since both its rodents and has mountain landscaping ranging from 1,500 to 1,800 m above sea level.

METHODS

Trapping design

Three observation stations were established, each was located at the foot, middle and top of Gunung Botol, as representation of the altitudinal differentiation. Details of stations for this study are given in Table 1. One hundred and twenty one local wire rat traps of dimension 25 x 10 x 10 cm, which has a door that closes when a baited hook releases an attachment to the door, were placed in each station of 100 x 100 m. Trapping design for each station were the same as follows. Each station had ten trap lines. One trap line comprised 11 traps with salted-fish bait were placed with interval about 10 m for each, and each

trap-line alternated with the next trap-line at a spacing of 10 m.

The traps were set at each station for five days. Traps checking was done every morning, while re-baiting normally every two days depend on bait condition.

Ear tagging

Trapped rats were put into cotton bag with dimension of 45 x 30 cm. Measurements of weight, head, and body length, tail length, hindfoot length and ear length were taken using digital calipers. Rats were then identified. Systematic arrangement followed Corbet and Hill, 1992 and Suyanto *et al.*, 1998. Ear tagging for each individual was given by making little cut on their ear. Each ear-cut had different meaning, so it could be used as identification for each individual rat. The rat was then released at its origin trapped place.

Data analyses

Computations for all statistical analyses were conducted using SPSS statistical package (Greene* a/, 1997).

RESULTS

Four observations were conducted, each observation was set for 5 days at each station. These were November 1998, twice in March 1999 and December 1999. The summary of captured data for all observations are presented in Table 2 and Figure 1. From all rodent captured can be detected at least 4 species of rodent were occurred in Gunung Botol, these were: *Maxomys bartelsii*, *Niviventer lepturus*, *Niviventer fulvescens* and *Niviventer cremoriventer.*

In sum up, our observations can be explained as follows:

Biodiversity

Maxomys bartelsii **and** *Niviventer* ***lepturus.***

These two species of murid were the most widespread species at Gunung Botol. Although occurred from an altitude of 1,560 to 1,818 m, they showed a tendency changes in abundance along this elevational stations. *Maxomys bartelsii* was densest at altitude about 1,560 m. Less captures of *Maxomys bartelsii* were detected at higher altitude, where it was commonly found in association with *Niviventer lepturus.* The later species was also recorded from all stations, however most captures was from top of the mountain. *Niviventer lepturus* also showed a trend of its distribution along the altitudinal changes, but seemed to be positively correlated with altitude.

Niviventer fulvescens **and** *Niviventer remoriventer.*

These two species of rat were found in low numbers between an altitudes of 1,560 and 1,683 m asl. *Niviventer fulvescens* was recorded only two occasions, both were from foot of Gunung Botol at an altitude of 1,560 m. *Niviventer cremoriventer* was the most striking record in this study. One individual of this species was trapped elsewhere only from mountain middle at an altitude of 1,683 m.

Table 1. Locality details of stations examined in this study

Station	Longitude (East)	Latitude (South)	Altitude (Metres)
Mountain top	106°28'54.6"	6°43'37.2"	1,818
Mountain middle	106°29'04.5"	6°43'38.5"	1,683
Mountain foot	106°29'12.2"	6°43'40.2"	1,560

Table 2. Summary of numbers of individual rat observed in this study-

Species	Mountain top	Mountain middle	Mountain foot	Total
Maxomys bartelsii	14	15	30	59
Niviventer lepturus	23	21	6	50
Niviventer fulvescens	0	0	2	2
Niviventer cremoriventer	0	1	0	1
Total	37	37	38	112

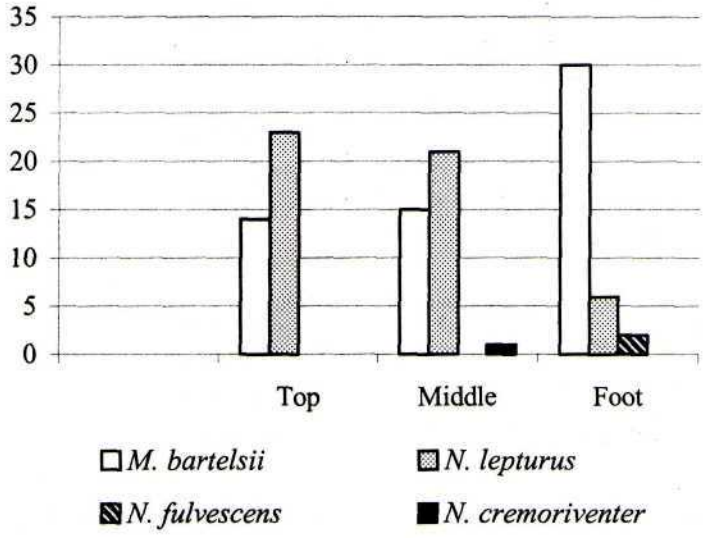

Figure 1. Histogram of individual rat distribution for the three of stations observed.

Distribution and Abundance

Further investigation of the patterns of rat distribution was undertaken using a one-sample chi-square test (Green *et al.,* 1997). *Niviventer fulvescens* and *Niviventer cremoriventer* was a clear exception for this analysis, both having only two and one individuals. Then, *Niviventer fulvescens* and *Niviventer cremoriventer* were excluded from this analysis because they were clearly outliers and may strongly influenced the statistical validity of the results.

The chi - square test revealed that the distribution of both *Maxomys bartelsii* and *Niviventer lepturus* were significantly associated with altitude. *Maxomys bartelsii* was detected in more abundance in lower latitude, while *Niviventer lepturus* showed a positive correlation with latitude (significance level for *M. bartelsii* was $P<0.05$ and *N. lepturus* was $P<0.01$). Latitude may have indirect effect on the distribution of species through habitat variation. Therefore, regression analysis on the canopy, ground covering and tree circumference was undertaken to see if these three factors significantly differ for each station.

The regression analysis on the two environment factors was statistically significant associated with station latitude indicating environment variation was so impressive among the three stations examined (see Table 3). The F values for ground covering 12.95** and tree circumference 3.84*. The significant of ground covering related to the fact that average values for mountain top was 12.78%, whereas in middle and mountain foot were 37.04% and 40.93%, respectively. Tree circumference also had significant interaction with station latitude. This related that in mountain middle had average circumference being smaller (10.65 cm) than top (17.70 cm) and mountain foot (24.04 cm).

The regression of canopy on latitude yielded an intercept of 0.34. This intercept did not quite reach statistical significant ($F = 3.77$, $P = 0.06$ with 2 degrees of freedom). Assuming this trend is statistically significant, then there was possible contributing factor of canopy in determining rat distribution. The Average value for canopy covering for mountain top was 43.70%, whereas in middle and mountain foot was 60.42% and 72.33%, respectively.

rats were captured from the same traps using same bait, indicating there was no differences in habitat used for their activities such as foraging and reproduction. If more than one species live in same habitat and use it in similar ways, will enhance habitat used portioning by keep themselves apart from each other (Patterson *et ah*, 1990). This could lead to more directional habitat selection for particular species.

Taken together, this suggested that distribution and abundance of rat species at Gunung Botol might resulted from the association of different environment factors by altitudinal changes and interspecific competition.

Population data of this study indicated there was no differences between stations examined indicating all altitudes along Gunung Botol range were important habitat. No matter the explanation, conservation effort should be focussed in this area. Moreover, the two species observed i.e. *M. bartelsii* and *N. lepturus* confined to mountain and recorded from Jawa only. Being very limited distributed, these two species of rat may be susceptible to extinction and therefore, again, of importance for conservation effort.

CONCLUSIONS

1. This study documented that at least 4 species of rat occurred at Gunung Botol. Two of them i.e. *Maxomys bartelsii* and *Niviventer lepturus* were the most widespread species. While *Niviventer fulvescens* and *Niviventer cremoriventer* were detected in low numbers in the middle and foot of the mountain. Their distribution also indicated significant correlation with environment factors associate with altitudinal gradient.
2. Our data resulted from this study documented the distribution and abundance of rodent fauna along elevational gradients of Gunung Botol will provide valuable information needed to maximize conservation efforts, especially for those species that have very limited distribution.

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